CLAIMS

The invention claimed is:

1. An atomic layer deposition method comprising utilization of one or both of an electric field gradient and a magnetic field gradient within an atomic layer deposition reaction chamber to align molecules during the atomic layer deposition as at least portions of the molecules are incorporated into a material formed over a semiconductor substrate.

2. The method of claim 1 wherein a plasma is present in the atomic layer deposition reaction chamber during the incorporation of at least portions of the molecules into the material.

3. The method of claim 1 wherein the magnetic field gradient is utilized.

4. The method of claim 1 wherein the electric field gradient is utilized.

5. The method of claim 4 wherein:

the atomic layer deposition reaction chamber has a lower portion and an upper portion;

the substrate is in the lower portion; and

the electric field gradient is formed by electrically biasing the substrate relative to one or more structures in the upper portion of the atomic layer deposition reaction chamber.

6. The method of claim 4 wherein:

the molecules are first molecules;

the atomic layer deposition process comprises provision of second molecules into the atomic layer deposition reaction chamber at a substantially non-overlapping time relative to the first molecules and incorporation of at least portions of the second molecules into the material formed over the semiconductor substrate; and

the electric field gradient is removed from within the atomic layer deposition reaction chamber prior to incorporating at least portions of the second molecules into the material.

7. The method of claim 6 wherein the first molecules are ammonia and the second molecules are $SiCl_4$.

8. The method of claim 4 wherein:

the molecules are first molecules;

the atomic layer deposition process comprises provision of second molecules into the atomic layer deposition reaction chamber at a substantially non-overlapping time relative to the first molecules and incorporation of at least portions of the second molecules into the material formed over the semiconductor substrate; and

the electric field gradient remains within the atomic layer deposition reaction chamber during the incorporation of at least portions of the second molecules into the material.

9. The method of claim 4 wherein:

the molecules are first molecules;

the atomic layer deposition process comprises provision of second molecules into the atomic layer deposition reaction chamber at a substantially non-overlapping time relative to the first molecules and incorporation of at least portions of the second molecules into the material formed over the semiconductor substrate;

the electric field gradient is in a first configuration during the incorporation of at least portions of the first molecules into the material and is in a second configuration, different from the first configuration, during the incorporation of at least portions of the second molecules into the material.

10. The method of claim 4 wherein:

the molecules are first molecules;

the electric field gradient is in a first configuration during the incorporation of at least portions of the first molecules into the material;

the first configuration of the electric field gradient comprises an increase of the electric field along a first vector within the atomic layer deposition chamber during the alignment of the first molecules;

the atomic layer deposition process comprises provision of second molecules into the atomic layer deposition reaction chamber at a substantially non-overlapping time relative to the first molecules and incorporation of at least portions of the second molecules into the material formed over the semiconductor substrate;

after the incorporation of at least portions of the first molecules into the material, the electric field gradient is changed to a second configuration in which the electric field increases along a second vector different from the first vector; and

the electric field gradient remains in the second configuration during the incorporation of at least portions of the second molecules into the material.

11. The method of claim 10 wherein an angular difference between the first and second vectors is about 180 degrees.

12. A method of forming a material over a semiconductor substrate, comprising:

providing a semiconductor substrate within a reaction chamber;

flowing at least two different precursors into the reaction chamber at different and substantially non-overlapping times relative to one another to form the material over at least a portion of the substrate;

wherein at least one of the precursors is asymmetric with respect to a physical property;

wherein a field influencing the asymmetric physical property is oriented within the reaction chamber; and

wherein the influence of the oriented field affects alignment of the precursor having the asymmetric property within the reaction chamber.

13. The method of claim 12 wherein at least one of the precursors lacks any asymmetric property influenced by the field.

14. The method of claim 13 wherein the field is removed from the reaction chamber when the at least one of the precursors lacking any asymmetric property influenced by the field is flowed into the reaction chamber.

15. The method of claim 12 wherein:

two or more of the precursors are asymmetric relative to the physical property and thus have alignments influenced by the field; and

an orientation of the field within the reaction chamber is changed when one of the two or more of the precursors is flowed into the chamber relative to when another of the two or more of the precursors is flowed into the reaction chamber.

16. The method of claim 12 wherein the oriented field is a magnetic field.

17. The method of claim 12 wherein the oriented field is an electric field.

18. The method of claim 17 wherein the physical property to which the at least one precursor is asymmetric is an electronic distribution around the precursor.

19. The method of claim 18 wherein the precursor which is asymmetric relative to the physical property is electrically neutral.

20. The method of claim 19 wherein the precursor which is asymmetric relative to the physical property is ammonia.

21. The method of claim 12 wherein the at least two different precursors comprise ammonia and $SiCl_4$, wherein the physical property is an electronic distribution, and wherein the at least one precursor which is asymmetric relative to the physical property includes the ammonia.

22. A method of forming a material over a semiconductor substrate, comprising:

providing a semiconductor substrate within a reaction chamber;

flowing a precursor into the reaction chamber as part of an atomic layer deposition process utilized to form the material over at least a portion of the substrate, the precursor within the reaction chamber being in the form of a population of individual precursor molecules;

wherein the individual precursor molecules have an anisotropic charge distribution, and have an electronic axis extending from a relatively electrically negative pole of the molecules to a relatively electrically positive pole of the molecules;

wherein an electric field within the reaction chamber is oriented while the precursor is within the reaction chamber; and

wherein the oriented electric field influences an averaged direction of the electronic axes within the population of the precursor molecules within the reaction chamber.

23. The method of claim 22 wherein the precursor comprises nitrogen and hydrogen.

24. The method of claim 22 wherein:

the precursor is a first precursor; and

the atomic layer deposition process comprises provision of a second precursor within the reaction chamber at a substantially non-overlapping time relative to the first precursor.

25. The method of claim 24 wherein the first precursor is ammonia and the second precursor is $SiCl_4$.

26. The method of claim 22 wherein:

the precursor is a first precursor;

the atomic layer deposition process comprises provision of a second precursor within the reaction chamber at a substantially non-overlapping time relative to the first precursor; and

the electric field is removed from within the reaction chamber prior to providing the second precursor within the reaction chamber.

27. The method of claim 26 wherein the first precursor is ammonia and the second precursor is $SiCl_4$.

28. The method of claim 22 wherein:

the precursor is a first precursor;

the atomic layer deposition process comprises provision of a second precursor within the reaction chamber at a substantially non-overlapping time relative to the first precursor; and

the electric field remains within the reaction chamber during the provision of the second precursor within the reaction chamber.

29. The method of claim 22 wherein:

the precursor is a first precursor;

the electric field is in a first configuration to align the averaged direction of the electronic axes of the population of the first precursor molecules within the reaction chamber;

the first configuration of the electric field comprises an increase of the electric field along a first vector within the reaction chamber;

the atomic layer deposition process comprises provision of a second precursor within the reaction chamber at a substantially non-overlapping time relative to the first precursor;

prior to, during, or after provision of the second precursor within the reaction chamber, the electric field gradient is to a second configuration in which the electric field increases along a second vector different from the first vector; and

the electric field remains in the second configuration for at least part of a time that the second precursor is within the reaction chamber.

30. The method of claim 29 wherein an angular difference between the first and second vectors is about 180 degrees.

31. The method of claim 22 wherein:

the reaction chamber has an upper portion and an opposing lower portion;

the substrate is provided in the lower portion of the reaction chamber;

the precursor is flowed through the upper portion of the reaction chamber; and

the electric field within the chamber is formed by electrically biasing the upper portion of the chamber relative to the lower portion.

32. The method of claim 31 wherein the electric field is formed by electrically biasing the substrate relative to one or more structures in the upper portion of the chamber.

33. The method of claim 31 wherein the precursor is flowed into the chamber through a dispersal structure having one or more orifices extending therethrough, and wherein the electric field is formed by electrically biasing the substrate relative to the dispersal structure.

34. The method of claim 33 wherein the dispersal structure is a showerhead.